Spinal MRI Utilization in Patients with Early-Onset Scoliosis – Review of a Multi-Center Database

Anna McClung, Brendan A. Williams, Suken A. Shah, Laurel C. Blakemore, Jeff Pawelek, Paul D. Sponseller, Stefan Parent, John B. Emans, Peter F. Sturm, Burt Yaszay, Behrooz A. Akbarnia, and the Growing Spine Study Group
Background

• Spinal MRI is commonly included in the evaluation of EOS due to higher frequencies of intraspinal abnormalities reported in this population

• Actual provider utilization of this imaging modality across the EOS spectrum has not been well described
Objectives

1) To report patterns of MRI utilization in patients with EOS across an international cohort of centers regularly treating patients with this condition

2) To determine if patient-related variables are associated with MRI use prior to treatment in EOS
Methods

Design: *Retrospective review of a prospective, multi-center database*

Inclusion criteria: *Idiopathic, Congenital, Neuromuscular or Syndromic EOS*

Exclusion criteria:
- *Incomplete or unverifiable data regarding pre-treatment imaging*
- *Structural deformities secondary to tumor or infection*

Independent variables:
- *Patient demographics: Age, race/ethnicity*
- *Etiology of EOS*
- *Major curve size (Degrees)*
- *Type of treatment (Operative or Non-operative)*

Dependent variable: *Pre-treatment MRI (MRI Obtained or No MRI Obtained)*
Statistical Analysis

• Demographic, clinical and radiographic characteristics summarized with descriptive statistics

• Univariate analyses were performed using Pearson’s chi-square ($\chi^2$) for categorical variables and two-tailed student’s t-test for continuous variables

• Multivariate logistic regression was performed to identify significant predictors of MRI utilization
Cohort Demographics

- 1,343 (70%) of total registry subjects managed at 21 institutions by 50 surgeons met study criteria
- Age at treatment: 6.3 +/- 3.5 years
- Major curve prior to treatment: 66 +/- 25 degrees
- Treatment type was surgical in 75% of patients

**Patient Etiology**

- Presumed Idiopathic: 446 (33%)
- Syndromic: 369 (28%)
- Neuromuscular: 317 (23%)
- Congenital: 211 (16%)
MRI Utilization

- MRI was obtained in 62% (836/1343) of patients at a mean age of 5.8 ± 4.0 years.
- MRI Utilization showed no association (p>0.05) with gender, treatment type, major curve size and age at treatment.
## MRI Utilization - By Etiology

### Univariante Analysis

<table>
<thead>
<tr>
<th>Etiology</th>
<th>MRI Obtained n = 836 (62%)</th>
<th>No MRI Obtained n = 507 (38%)</th>
<th>P - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presumed Idiopathic</td>
<td>314 (37.6%)</td>
<td>132 (26.0%)</td>
<td></td>
</tr>
<tr>
<td>Syndromic</td>
<td>232 (27.8%)</td>
<td>137 (27.0%)</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Neuromuscular</td>
<td>134 (16.0%)</td>
<td>183 (36.1%)</td>
<td></td>
</tr>
<tr>
<td>Congenital</td>
<td>156 (18.7%)</td>
<td>55 (10.9%)</td>
<td></td>
</tr>
</tbody>
</table>

### Multivariate Regression

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Odd Ratio</th>
<th>95% CI</th>
<th>Adjusted OR*</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syndromic</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Neuromuscular</td>
<td>0.4</td>
<td>(0.32, 0.59)</td>
<td>0.4</td>
<td>(0.31, 0.57)</td>
</tr>
<tr>
<td>Idiopathic</td>
<td>1.4</td>
<td>(1.05, 1.88)</td>
<td>1.4</td>
<td>(1.03, 1.87)</td>
</tr>
<tr>
<td>Congenital</td>
<td>1.7</td>
<td>(1.15, 2.43)</td>
<td>1.6</td>
<td>(1.09, 2.31)</td>
</tr>
</tbody>
</table>

*Adjusted for race/ethnicity
## MRI Utilization - By Race/Ethnicity

### Univariate Analysis

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>MRI Obtained n = 836 (62%)</th>
<th>No MRI Obtained n = 507 (38%)</th>
<th>P - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>White/Caucasian</td>
<td>524 (62.7%)</td>
<td>324 (63.9%)</td>
<td></td>
</tr>
<tr>
<td>African/African-American</td>
<td>112 (13.4%)</td>
<td>61 (12.0%)</td>
<td>P &lt; 0.05</td>
</tr>
<tr>
<td>Hispanic</td>
<td>72 (8.6%)</td>
<td>29 (5.7%)</td>
<td></td>
</tr>
<tr>
<td>Asian/Asian-American</td>
<td>37 (4.4%)</td>
<td>10 (2.0%)</td>
<td></td>
</tr>
<tr>
<td>Other/Unspecified</td>
<td>91 (11%)</td>
<td>83 (16.4%)</td>
<td></td>
</tr>
</tbody>
</table>

### Multivariate Regression

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<th>95% CI</th>
<th>Adjusted OR*</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>White/Caucasian</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>African/African-American</td>
<td>1.1</td>
<td>(0.81, 1.60)</td>
<td>1.2</td>
<td>(0.81, 1.65)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.5</td>
<td>(0.98, 2.41)</td>
<td>1.7</td>
<td>(1.07, 2.73)</td>
</tr>
<tr>
<td>Asian/Asian-American</td>
<td>2.3</td>
<td>(1.12, 4.66)</td>
<td>2.4</td>
<td>(1.13, 4.88)</td>
</tr>
<tr>
<td>Other/Unspecified</td>
<td>0.7</td>
<td>(0.49, 0.94)</td>
<td>0.7</td>
<td>(0.53, 1.05)</td>
</tr>
</tbody>
</table>

*Adjusted for etiology
Discussion

• Two-thirds of EOS patients across a international, multicenter cohort of treating centers underwent spinal MRI prior to intervention

• MRIs were utilized more commonly among presumed Idiopathic and Congenital etiologies and least commonly among Neuromuscular etiologies

• MRI use appeared greatest in Asian/Asian-American populations
Limitations

- Registry studies rely upon the accuracy and consistency of data collected at participating centers.

- Other factors potentially influencing MRI decision-making (e.g. physical exam findings) could not be examined.
References